DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AIR QUALITY CONTROL CONSTRUCTION PERMIT

Permit No.: 098CP01 **Proposed: November 2, 2004**

The Department of Environmental Conservation (Department), under the authority of AS 46.14 and 18 AAC 50, issues an Air Quality Control Construction Permit to

Operator and Permittee:	**Alyeska Pipeline Service Company** 900 E. Benson Blvd. Anchorage, AK 99508
Owner:	Owners of the Trans Alaska Pipeline System
Stationary Source:	**Trans-Alaska Pipeline System Pump Station 5**
Location:	Latitude 66°48’ 47” North; Longitude 150º 39’ 43” Sections 18 and 19, T23N, R14W, Fairbanks Meridian
Physical Address:	Same as Location
Permit Contact:	Don Mark Anthony (907) 450-7652

The Department authorizes Alyeska Pipeline Service Company’s requested emission limits to classify Pump Station 5 as Hazardous Air Pollutant synthetic minor.

As required by AS 46.14.120, the Permittee shall comply with the terms and conditions of this construction permit.

This stationary source is classified under 18 AAC 50.300(b)(2), 18 AAC 50.300(c)(1), 18 AAC 50.325(b)(2), and 18 AAC 50.325(c). This project is an owner requested limit as set out by 18 AAC 50.305(a)(4).

John F. Kuterbach, Manager
Air Permits Program

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List of Abbreviations Used in this Permit

AAC ....Alaska Administrative Code
ADEC.........................Alaska Department of Environmental Conservation
AS ....Alaska Statutes
ASTM ....American Society of Testing and Materials
bhp.............................brake horsepower or boiler horsepower [1]
CEMS.........................Continuous Emission Monitoring System
C.F.R. ....Code of Federal Regulations
COMS ....Continuous Opacity Monitoring System
dscf.............................Dry standard cubic feet
EPA ....US Environmental Protection Agency
gr./dscf ....grain per dry standard cubic feet (1 pound = 7000 grains)
GPH............................gallons per hour
HAP............................Hazardous Air Pollutant
HHV ....Higher heating value
ID ....Source Identification Number
kW..............................kilowatts
MACT ....Maximum Achievable Control Technology
Mlb ....thousand pounds
MMBtu.......................Million British Thermal Units
NAICS ....North American Industry Classification System
NESHAPs ....Federal National Emission Standards for Hazardous Air Pollutant
NSPS ....Federal New Source Performance Standards [as defined in ...... 40 C.F.R. 60]
ppm ....Parts per million
ppmv ....Parts per million volume
PS ....Performance specification
PSD ....Prevention of Significant Deterioration
RM ....Reference Method
SIC ....Standard Industrial Classification
TPH ....Tons per hour
TPY ....Tons per year
Wt% ....weight percent

Pollutants

CO ....Carbon Monoxide
HAPS ....Hazardous Air Pollutants [as defined in AS 46.14.990(14)]
H_2S ....Hydrogen Sulfide
NO_x ....Oxides of Nitrogen
PM-10 ....Particulate Matter [as defined in 18 AAC 50.990(70)]
SO_2 ....Sulfur Dioxide
VOC ....Volatile Organic Compound [as defined in 18 AAC 50.990(103)]

[1] 1 boiler horsepower = 33,472 Btu-fuel per hp-hr divided by the boiler's efficiency. Approximately 7000 Btu-fuel per bhp-hr is required for an average diesel Internal Combustion engines.

Section 1 Owner Requested Limits to Avoid Classification as a HAP Major Facility

1. **Limits to Avoid HAP-Major Classification at Pump Station 5.** To avoid classification as a Hazardous Air Pollutant (HAP) Major Stationary Source under 18 AAC 50.300(f), the Permittee shall limit the HAP emissions from the crude oil breakout tank (Tank 150), described in Table 1 of Operating Permit No. 098TVP01, to no more than 8.1 tons per 12 month rolling period for any individual HAP and 18.5 tons per 12 month rolling period for the aggregate total of HAPs.

2. **Monitoring.** The Permittee shall monitor compliance with Condition 1 as follows:

   2.1 For the first twenty-four months sample the Pump Station 1 discharge crude stream no less than once every three calendar months at a consistent time each three-month period. After that twenty-four month period, sample the Pump Station 1 discharge crude stream no less than once every twelve months at a consistent time each twelve-month period. Unless an equivalent method is approved by the Department, the Permittee shall use Method ASTM D-5134M determine the amounts of the following HAPs: 1,3 butadiene, N-hexane, benzene, 2,2,4 trimethylpentane, toluene, ethyl benzene, xylenes, isopropyl benzene, and naphthalene. The Permittee is required to monitor as set out by Conditions 2.5 and 2.6 as identified.

   2.2 Monitor and record tank level changes and tank temperature at least once per hour. The total volume of crude oil routed to Tank 150 shall be monitored using tank level change indicators, or by another appropriate methodology approved by the Department. Calculate and record the monthly total volume of crude oil routed to Tank 150.

   2.3 For any period during which crude oil flow data is unavailable under Condition 2.2, the Permittee shall estimate the flow rate of crude oil to Tank 150 using a crude oil flow rate of 2,350,000 barrels per year (bbl/yr), prorated over the time period during which no data is available.

   2.4 For the first twenty-four months, calculate and record the quarterly HAP emissions from Tank 150 based on the most recent crude composition analysis in Condition 2.1, and using the volume of crude oil routed to the tank for that three-month period as set out by Conditions 2.2 or 2.3. For subsequent months, calculate and record the semi-annual HAP emissions from Tank 150, based on the most recent crude composition analysis in Condition 2.1, and using the volume of crude oil routed to the tank during that six-month period as set out by Conditions 2.2 or 2.3. Calculations shall be based on the methodology presented in the Permittee's October 14, 2003 permit application as described in Appendix A, or using a similar Department approved methodology.

2.5 If the calculated HAP emissions under Condition 2.4 exceed 80% of either of the limits under Condition 1, sample according to Condition 2.1 monthly, at a consistent time each month, until HAP emissions fall below 80% of the limits. Calculate and record the monthly HAP emissions from Tank 150 based on the monthly crude composition analysis, and using the volume of crude oil routed to the tank during that month as set out by Conditions 2.2 or 2.3. Calculations shall be based on the methodology presented in the Permittee's October 14, 2003 permit application as described in Appendix A, or using a similar Department approved methodology. Once the HAP emissions fall below 80%, return to the sampling periods according to Condition 2.1, and calculation frequency according to Condition 2.4.

2.6 If the calculated HAP emissions under Condition 2.4 exceed 90% of either of the limits under Condition 1, determine the amounts of the HAPs identified under Condition 2.1 emitted from Tank 150 on a monthly basis using the Gas Producers Association Method 2286, or an appropriate vapor phase analytical method approved by the Department rather than the testing method identified in Condition 2.1. Test at a consistent time each month until HAP emissions fall below 90% of the limits. Calculate and record the monthly HAP emissions from Tank 150 based on the analytical method analysis, and using the volume of crude oil routed to the tank during that month as set out by Conditions 2.2 or 2.3. Calculations shall be based on the methodology presented in the Permittee's October 14, 2003 permit application as described in Appendix A, or using a similar Department approved methodology. Once the HAP emissions fall below 90%, return to the sampling periods according to Condition 2.1, and calculation frequency according to Conditions 4.

2.7 Calculate and record the twelve-month rolling total HAP emissions using data collected in Conditions 2.4, 2.5 or 2.6.

3. **Reporting.** Report as follows:

3.1 Report under Condition 42, *Facility Operating Reports*, of Operating Permit No. 098TVP01, the following information:

a. the results of any sampling conducted during the reporting period as set out by Conditions 2.1, 2.5, and 2.6; and

b. the completed calculation spreadsheets showing the 12-month rolling total HAP emissions for each pollutant and the 12-month rolling aggregate total HAP emissions as calculated under Conditions 2.4, 2.5, 2.6, or 2.7.

3.2 Report under Condition 40, *Excess Emission and Permit Deviation Reports*, of Operating Permit No. 098TVP01, if:

a. the 12-month rolling total individual HAP emission from Tank 150 exceeds the limit in Condition 1;

b. the 12-month rolling total aggregate HAP emissions from Tank 150 exceeds the limit in Condition 1; or

c. the monitoring, recordkeeping, or reporting requirements are not in accordance with Conditions 2 or 2.6.

Section 2 Permit Documentation

October 12, 2003	Letter from Don Mark Anthony, Alyeska, to Jim Baumgartner, ADEC, with an Application for an Air Quality Control Construction Permit.
December 18, 2003	Letter from Jim Baumgartner, ADEC, to Don Mark Anthony, Alyeska, on the completeness review of the application.
January 16, 2004	Letter from Don Mark Anthony, Alyeska, to Jim Baumgartner, ADEC, with Response to Comments from Completeness request of December 18, 2003.
July 19, 2004	Letter from Don Mark Anthony, Alyeska, to Jim Baumgartner, ADEC, with Amendment to TAPS Pump Station 5 HAP ORL Permit Application.
October 21, 2004	Electronic mail from Don Mark Anthony, Alyeska, to Jeanette Brena, ADEC, with supplemental information to TAPS PS 5 HAP ORL permit application.

Appendix A

Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

This Appendix provides a step-by-step procedure for determining the Hazardous Air Pollutants (HAPs) for the crude oil storage tank vapors. Alyeska will conduct laboratory tests of the crude oil to determine the weight fraction of various components. These weight fractions are then used, through many calculations, to determine the HAP emission rate from the tank.

I. Sample Description/Comments

1. Sample location ______________________________
2. Sample Date ______________________________
3. Sample ID. ______________________________
4. Core Laboratories data includes crude molecular weight and component wt% values.

Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

II. Determine Component Mole Fractions in Liquid Crude

Methodology Assumptions/comments:

1. The component mole fraction in crude is determined from component weight fraction and component molecular weight by assuming a mass of 1,000 lb of crude (see AP-42 Section 7.1.5).

2. The component molecular weight of Decanes+ is equal to the value required for the sum of all molecula weights to be equal to the Core Laboratories measured crude molecular weight of: ________lb/lb-mole

Liquid Crude Analysis Data		Calculate Component Mole Fraction in Crude			
Component I	Component Weight Fraction in Crude (wt%/100) Z_{Li}	Component Molecular Weight Mi	Total Moles of Crude (sum ZLi/Mi x 1000) X_T	Component Mole Fraction in Crude (ZIi/Mi/XT) Xi	Crude Molecular Weight (sum Mi*Xi) M_T
Methane		16			
Ethane		30			
Propane		44			
Isobutane		58			
N-Butane		58			
1,3 Butadiene		54			
Isopentane		72			
N-Pentane		72			
N-Hexane		86			
Hexane		84			
Benzene		78			
Heptanes		97			
2,2,4 Trimethylpentane		114			
Toluene		92			
Octanes		111			
Ethyl Benzene		106			
Xylenes		106			
Isopropylbenzene		120			
Nonanes		123			
Naphthalene		128			
Decanes+		395			
SUM $Z_{Li}/X_T/Xi/M_T$	1.00			1.00	

Note:

1. Molecular weight values for component groups such as octanes are estimates from Core Laboratories.

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Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

III. Determine Component Vapor Pressure at Given Crude Temperatures

Methodology Assumptions/Comments

1. Clausius-Clapeyron equation provides relationship between temperature and vapor pressure:

$$\log P_2/P_1 = H_v/2.303R^*(T_2-T_1/T_2T_1)$$

where R= Universal Gas Constant = 8.31448 J/g-mole.K = 3.58 Btu/lb-mole.K
H_v = Heat of Vaporization = see table below

2. Let P_1 be known component vapor pressure at known temperature T_1 = 100 F (311 K), and P_2 be unknown component vapor pressure at given crude temperature T_2 (shown below).

3. Pump station crude (and vapor) constant temperature (P_2) of: 87 F = 304 K
Based on average crude temperature at this pump station during peak flow year 1995

Component Physical Properties			Component Vapor Pressure At Crude Temperatures			
Component I	Component Vapor Pressure at 100F (psia) P_1	Component Heat of Vaporization (Btu/lb-mole) H_v	Component Heat of Vaporization/ Gas Constant $H_v/2.303R$	Calculate $(T_2-T_1)/T_2T_1$	Calculate Inverse Log of $(Hv/2.303R)^*$ $(T_2-T_1)/T_2T_1$	Component Vapor Pressure at Crude Temperature (psia) P_2
Methane		3520	426.9			
Ethane		6349	770.1			
Propane		8071	978.9			
Isobutane		9136	1108.2			
N-Butane		9642	1169.5			
1,3 Butadiene		10025	1215.9			
Isopentane		10613	1287.3			
N-Pentane		11082	1344.2			
N-Hexane		12404	1504.5			
Hexane		12500	1516.1			
Benzene		13215	1602.8			
Heptanes		13500	1637.4			
2,2,4 Trimethylpentane		14000	1698.1			
Toluene		14263	1730			
Octanes		14500	1758.7			
Ethyl Benzene		15288	1854.3			
Xylenes		16000	1940.6			
Isopropylbenzene		16136	1957.1			
Nonanes		16500	2001.3			
Naphthalene		16700	2025.5			
Decanes+		47282	5734.7			

Note:
1. Heat of Vaporization and vapor pressure of pure components from GPSA Engineering Data Bk. Vol. II Sec
2. Vapor Pressure values for component groups such as octanes are estimates from Core Laboratories.
3. Heat of Vaporization values for component groups are estimates based on values for individual componen within the group.

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Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

IV. Determine Component Partial Pressure and Mole Fraction in Crude Vapor

Methodology Assumptions/Comments

1. Conservatively assume C_1 through C_{10} hydrocarbons and HAP's are only species present in vapor phase due to dramatic dropoff in component vapor pressure as component molecular weight increases.

2. For speciation purposes, assume crude vapor pressure (P_{VA}) equal to sum of component partial pressures indicated below. This assumption ignores CO_2 present in crude and is conservative because it results in vapor mole fractions of listed components (including HAP's) being overstated.

3. Component partial pressure is equal to the component mole fraction in the liquid crude multiplied by the component vapor pressure at the given crude temperature:

$$P_i = P_2 * X_i$$

4. The component mole fraction in the crude vapor is then equal to the component partial pressure divided by the overall crude vapor pressure:

$$y_i = P_i/P_{VA}$$

	Calculation of Component Partial Pressure and Mole Fraction in Vapor			
Component I	Component Vapor Pressure at Crude Temperature (psia) P_2	Component Mole Fraction in Crude ($Z_{i,j}/M/X_T$) Xi	Component Partial Pressure at Crude Temperature (P2*Xi) Pi	Component Mole Fraction in Vapor (P_i/P_{VA}) y_i
Methane				
Ethane				
Propane				
Isobutane				
N-Butane				
1,3 Butadiene				
Isopentane				
N-Pentane				
N-Hexane				
Hexane				
Benzene				
Heptanes				
2,2,4 Trimethylpentane				
Toluene				
Octanes				
Ethyl Benzene				
Xylenes				
Isopropylbenzene				
Nonanes				
Naphthalene				
Decanes+				
P_{VA}/y_i SUM				1.00

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Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

V. Determine Component Weight Fractions in Crude Vapor

1. Component weight fraction in the vapor is determined in two steps. First, the overall vapor molecula weight is determined by summing the product of the molecular weight and vapor mole fraction for each component:

$$M_v = \text{Sum } (M_i{}^*y_i)$$

2. The component weight fraction is determined by dividing the product of the molecular weight and vapor mole fraction for each component by the overall vapor molecular weight:

$$Z_{vi} = (M_i{}^*y_i)/M_v$$

Component Physical Properties		Calculation of Component Weight Fraction in Vapor		
Component I	Component Molecular Weight Mi	Component Mole Fraction in Vapor (P_i/P_{VA}) y_i	Calculate Vapor Molecular Weight (sum Mi*yi) M_v	Component Weight Fraction in Vapor ($M_i{}^*y_i/M_v$) Z_{vi}
Methane	16			
Ethane	30			
Propane	44			
Isobutane	58			
N-Butane	58			
1,3 Butadiene	54			
Isopentane	72			
N-Pentane	72			
N-Hexane	86			
Hexane	84			
Benzene	78			
Heptanes	97			
2,2,4 Trimethylpentane	114			
Toluene	92			
Octanes	111			
Ethyl Benzene	106			
Xylenes	106			
Isopropylbenzene	120			
Nonanes	123			
Naphthalene	128			
Decanes+	395			
y_iSUM/M_v/Z_{vi}SUM		1.00		1.00

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Appendix A -- Procedure for HAP Content of Crude Oil Storage Tank Vapors

1. The TOC emissions (losses) are determined from EPA's TANKS 4.0 Program. Individual component emission rates (losses) are then determined using the vapor phase weight fractions previously determined for each component

$$L_{Ti} = Z_{vi} * L_T$$

2. Based on a maximum flow of crude to the breakout tank of: ____________ bbl/yr
____________ gal/yr

The Total TOC losses from the breakout tank are: ____________ lb/yr
____________ tpy

Calculation of Component Emission Rates (Losses)				
Component I	Component Weight Fraction in Vapor Z_{vi}	TOC Losses (from TANKS) L_T	Component Emission Rate/Loss L_{Ti}	Total HAP Emission Rate/Losses L_{HAP}
Methane				N/A
Ethane				N/A
Propane				N/A
Isobutane				N/A
N-Butane				N/A
1,3 Butadiene				
Isopentane				N/A
N-Pentane				N/A
N-Hexane				
Hexane				N/A
Benzene				
Heptanes				N/A
2,2,4 Trimethylpentane				
Toluene				
Octanes				N/A
Ethyl Benzene				
Xylenes				
Isopropylbenzene				
Nonanes				N/A
Naphthalene				
Decanes+				N/A
L_{Ti}SUM/L_{HAP}SUM				

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